CLAIMS

What is claimed is:

1. A low-water cut-off system for determining if water falls below a predetermined level within a water-containing enclosure, comprising:

a signal generator operative to introduce a signal into the water-containing enclosure such that the signal is present for sensing within water at the predetermined level,

a probe at the predetermined level capable of sensing the presence of the signal within the water if the water is at the predetermined level, and

a control responsive to the probe sensing for providing a control function in response to whether the signal is so sensed by the probe in order to indicate thereby whether water has dropped below the predetermined level, wherein the signal is transmitted through water in the water-containing enclosure according to the value of electrical conductivity of the water, the system including a provision for selectively adjusting the sensitivity of the probe sensing according to said value.

2. The low-water cut-off system according to claim 1 wherein the control function is an indication that water has fallen below the predetermined level, and including a circuit arrangement to selectively set either a delay on make or delay on break time, or both, for indication that water has fallen below the predetermined level.

3. The low-water cut-off system according to claim 2 wherein the signal is of a periodic nature.

4. A fluid-level detecting system for determining if fluid is at a predetermined level within a fluid-containing space in which fluid could be at the predetermined level, the fluid being transmissive of a signal, comprising:

signal generating circuitry capable of introducing such a signal into the fluid-containing space such that the introduced signal is present for sensing within fluid at the predetermined level if, and only if, the fluid is at least as high as the predetermined level,

a probe and probe-responsive circuitry capable of sensing the presence of the introduced signal within the fluid at the predetermined level,

control circuitry capable of providing a control function in response to whether the introduced signal is so sensed, in order to indicate whether the fluid has a level at least as high as the predetermined level wherein the signal is transmitted through water in the fluid-containing enclosure according to the value of electrical conductivity of the water, and

a provision for selectively adjusting the sensitivity of the probe responsive circuitry according to a value of electrical conductivity of the fluid.

5. Apparatus responsive to presence of a fluid at a predetermined level within a fluid-receiving space in which the fluid can rise to the predetermined level and for providing a control function if a level of the fluid shifts from the predetermined level, comprising:

signal generating circuitry capable of introducing a level-determining signal into the fluid-containing space such that the periodic signal is present for sensing within fluid at the

predetermined level if, and only if, the fluid level is at least as high as the predetermined level,

probe and probe-responsive circuitry having a sensitivity capable of sensing the presence of the periodic signal within the fluid at the predetermined level,

wherein the probe is configured for being inserted into the fluid-receiving space at the predetermined level, and

control circuitry capable of providing a control function in response to whether the level-determining signal is so sensed, in order to indicate whether the fluid has a level at least as high as the predetermined level,

whereby the control function may be used for alarm or cut-off purposes if the fluid level shifts relative to the predetermined level, said signal being transmitted through the fluid in the fluid-receiving space according to the value of electrical conductivity of the fluid, and the system including a provision for selectively adjusting the sensitivity of the probe-responsive circuitry according to said value.

6. The apparatus as set forth in claim 5, wherein level-determining signal is bipolar, the control circuitry said control providing multiple signal paths for responding to respective different polarities of the bipolar signal sensed by the probe, whereby the control function is provided with fail-safe operation.

7. The apparatus as set forth in claim 5, wherein the probe-responsive circuitry comprises detector circuitry operatively associated with the probe for receiving and determining the periodic signal.

8. A low-water cut-off system for determining if water drops below a predetermined level within a water-containing enclosure, comprising:

a signal generator operative to introduce a bipolar signal into the water-containing enclosure such that the signal is present for sensing within water at the predetermined level,

a probe at the predetermined level capable of sensing the presence of the signal within the water if the water is at the predetermined level, and

a control responsive to the probe sensing for providing a control function in response to whether the signal is so sensed by the probe, in order to indicate whether the water has dropped below the predetermined level wherein the signal is transmitted through water in the water-containing enclosure according to the value of electrical conductivity of the water, the system including a provision for selectively adjusting the sensitivity of the probe sensing according to said value;

said control providing multiple signal paths for responding to respective different polarities of the bipolar signal sensed by the probe, and

a signalling circuit responsive only to proper operation of both signal paths, such that if one or the other of the signal paths fails to operate, a low water signalling will occur,

whereby low-water signalling operation is a fail-safe operation.

9. A low-water cut-off system for determining if water drops below a predetermined level within a water-containing enclosure, comprising:

a signal generator operative to introduce a signal into the water-containing enclosure such that the signal is present for sensing within water at the predetermined level,

a probe at the predetermined level capable of sensing the presence of the signal within the water if the water is at the predetermined level, and

a control responsive to the probe sensing for providing a control function in response to whether the signal is so sensed by the probe, in order to indicate thereby whether water has dropped below the predetermined level wherein the signal is transmitted through water in the enclosure according to the value of electrical conductivity of the water, the system including a provision for selectively adjusting the sensitivity of the probe sensing according to said value;

said control having a first network for response to positive-going pulses of said signal sensed by the probe, said first network being responsive to the presence or absence of said sensed signal, and providing a first low-water signal control operation;

said control having a second network for response to negative-going pulses of said signal sensed by the probe, said second network being responsive to the presence or absence of said sensed signal, and providing a second low-water signal control operation; and

a signalling circuit responsive only to both of said first and second low-water signal control operations, whereby to ensure fail-safe low-water signalling.

10. In a system for probe monitoring of liquid in a vessel by means of a probe associated with the vessel, including provision for introducing a bipolar periodic signal to the

vessel for being picked up by the probe, the improvement comprising

a probe signal-responsive control operable in response to sensing of the signal by the probe,

the control providing multiple signal paths for responding to respective different polarities of the bipolar signal sensed by the probe, and

a signalling provision responsive only to proper operation of both signal paths,

whereby response to the probe signal is fail-safe.

11. A method for determining the presence of a fluid at a predetermined level within a fluid-receiving space in which the fluid can rise at or above the predetermined level, comprising:

introducing a signal into the fluid-receiving space such that the signal is present for sensing within fluid at the predetermined level, wherein said signal is transmitted through water in the fluid-receiving space according to a value of electric conductivity of the water,

providing a probe at the predetermined level for sensing said signal,

sensing for the presence of the signal within the fluid at the predetermined level,

providing a control function in response to whether the signal is so sensed, in order to indicate whether the fluid is present at the predetermined level, and

selectively adjusting the sensitivity of the probe sensing according to said value.

12. A method of electronically determining whether fluid is at a predetermined level within a fluid-receiving space, comprising the steps of:

introducing a signal into the fluid-receiving space such that the signal is present for sensing within fluid at the predetermined level, the signal being transmitted through fluid in the fluid-receiving space according to a value of electric conductivity of the water,

providing a probe at the predetermined level for sensing said signal,

sensing for the presence of the signal within the fluid at the predetermined level,

providing a control function in response to whether the signal is so sensed, in order to indicate whether the fluid is or is not present at the predetermined level, and

selectively adjusting the sensitivity of the probe for sensing the presence of the signal in the fluid according to said value of electrical conductivity.

13. The method accord to claim 12 wherein the step of sensing for the presence of the signal is carried out by using a signal-responsive probe inserted into the fluid-receiving space at the predetermined level.

14. The method accord to claim 13 wherein the signal introduced into the fluid-receiving space is of a periodic nature.

15. The method accord to claim 13 wherein the periodic signal is coupled to the fluid in the space from a bipolar periodic signal generating circuit.

16. The method accord to claim 15, wherein the step of sensing for the presence of the signal at the predetermined level is carried out by using a detector circuit interconnected with the probe which detector circuit has dual signal paths, and

causing pulses of a first polarity to be processed in one signal path and pulses of an opposite polarity to be processed in the other signal path such that the control function is provided only in response to signal processing in both signal processes,

whereby to provide a fail-safe operation.

17. The method accord to claim 14, wherein the fluid has a characteristic having a value, subject to possible variation, which determines transmissivity of the signal through the fluid, the method further comprising adjusting sensitivity of the detector circuit according to said value.

18. The method accord to claim 12, wherein the control function is an indication that fluid is lower than said predetermined level.

19. The method accord to claim 12 wherein at least the sensing and control function providing steps are carried out under microcontroller control.

20. The method accord to claim 12 wherein the control function is an indication that fluid is lower than the

predetermined level, and at least the sensing and control function providing steps are carried out by microcontroller control, and by further using microprocessor control to determine either a delay on make or delay on break time, or both, for indication that fluid is lower than said predetermined level.

21. A method of probe monitoring of liquid in a vessel by use of a probe associated with the vessel, comprising

introducing a bipolar periodic signal to the vessel for being picked up by the probe,

using a probe signal-responsive control operable in response to sensing of the signal by the probe,

processing of the sensed signal, for purposes of signalling, in at least a pair of separate signal paths for responding to respective different polarities of the bipolar signal sensed by the probe, and

signalling in response only to proper operation of both of said at least a pair of signal paths,

whereby said signalling is a fail-safe operation.